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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/557,961	04/25/2000	Kunihiro Takatani	245402001600	8878

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EXAMINER
KANG, DONGHEE

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 11/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/557,961	Applicant(s) TAKATANI, KUNIHIRO	
	Examiner Donghee Kang	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 August 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 8-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5 and 8-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *13* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 12, 2002 has been entered.

Information Disclosure Statement

2. Acknowledgment is made of receipt of applicant's Information Disclosure Statement (PTO-1449) filed May 22, 2002.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claims **8-10 & 12** are rejected under 35 U.S.C. 102(e) as being anticipated by Okazaki (US 5,990,500).

Regarding claim 8, Okazaki discloses an electrode structure on a p-type III group nitride semiconductor layer, comprising first, second and third electrode layers successively stacked on said semiconductor layer (Fig.5A),

Said first electrode layer (8) comprising titanium (Ti); said second electrode layer (9) comprising copper (Co); and

Said third electrode layer (10) comprising gold (Au). *See also Col.7, lines 55-63 & Col.8, lines 55-58.*

Regarding claim 9, Okazaki discloses said first electrode layer has a thickness of 5 nm which is in a claimed ranges.

Regarding claim 10, Okazaki discloses said second electrode layer has a thickness of 5 nm which is in a claimed ranges.

Regarding claim 12, although Okazaki does not expressly teach first electrode layer includes a nitride of metal included in said first metal, and also includes a compound of Ga and a metal included in said second metal, this feature is inherent because the Okazaki's metal electrode structure is also treated by thermal process (Fig.5B) and the electrode structure of Okazaki is identical to the claimed electrode structure.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims **1-3, 5 & 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Okazaki (US 5,990,500).

Regarding claim **1**, Okazaki teaches an electrode structure on a p-type III group nitride semiconductor layer, comprising first, second and third electrode layers successively stacked on said semiconductor layer (Fig.5A),

Said first electrode layer (8) comprising titanium (Ti); said second electrode layer (9) comprising copper (Co); and

Said third electrode layer (10) comprising gold (Au). *See also Col.7, lines 55-63 & Col.8, lines 55-58.*

Okazaki does not teach the first electrode layer comprising Zr or Hf. However, one of ordinary skill in the art would have recognized that titanium (Ti), Zirconium (Zr) and Hafnium (Hf) are both considered to be an art recognized functional equivalent as an electrode layer for p-type nitride electrode, since they are all belong to same IVB group. Therefore, it would have been obvious in the art at the time the invention was made to replace Ti layer with Zr or Hf layer to form electrode layer for p-type nitride semiconductor in order to form the electrode layer on the p-type nitride semiconductor.

Regarding claim **2**, Okazaki discloses said first electrode layer has a thickness of 5 nm which is in a claimed ranges.

Regarding claim **3**, Okazaki discloses said second electrode layer has a thickness of 5 nm which is in a claimed ranges.

Regarding claims **5 & 14**, Okazaki teaches all claimed invention, as applied to claims 1 & 13 above, except for first electrode layer including a nitride and a compound Ga-Ni. In view of this invention, the Ti-N compound and the Ga-Ni compound were formed in first electrode layer by reaction during the thermal annealing process step as described in specification where

the N and Ga are supplied from GaN layer (page 6, lines 1-11). The first electrode in Okazaki's metal electrode structure is also treated by thermal process (Fig.5B) and the electrode structure of Okazaki is identical to the claimed electrode structure. Thus, the claimed structure is taken to be in the least obvious over Okazaki.

7. Claims **4, 11 & 13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Okazaki in view of Kim et al. (Mat. Res. Soc. Symp. Proc. Vol. 449, 1997, pp1061).

Regarding claims **4 & 11**, Okazaki does not expressly teach the third electrode layer has a thickness of 50 nm or more. However, it is conventional thickness ranges for Au electrode and also taught by Kim forming Au electrode layer having 50 nm thickness on Ni electrode. Thus it is an obvious matter of routine experimentation to find the optimal thickness range. Generally, difference in thickness of the various layers will not support the patentability of subject matter encompassed by the prior art. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

Regarding claim **13**, Okazaki teaches an electrode structure on a p-type III group nitride semiconductor layer, comprising first, second and third electrode layers successively stacked on said semiconductor layer (Fig.5A),

Said first electrode layer (8) comprising titanium (Ti); said second electrode layer (9) comprising copper (Co); and

Said third electrode layer (10) comprising gold (Au). *See also Col.7, lines 55-63 & Col.8, lines 55-58.*

In view of this invention, applicant noted that if a single Ti layer is formed on a p-type GaN layer, it functions as a Schottky electrode. However, it was found out that by uniformly

using a small amount of Ti hardly causes the Schottky effect and it serves as an interface reaction promoter. It is preferred that the first electrode layer has a thickness in a range from 1 to 500 nm (see page 3, lines 11-25). Okazaki does not teach the first electrode layer having a thickness of 10 to 500 nm. However, Okazaki teaches the first electrode layer having a thickness of 5 nm or less which is in the inventive thickness ranges so as to have same function with the claimed first metal electrode.

Okazaki does not expressly teach the third electrode layer has a thickness of 50 nm or more. However, it would have been obvious in the art for the same reason as given above.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on monday through friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308--956.

DHK
October 31, 2002

TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800